

REMARKS

An excess claim fee payment letter is submitted herewith for seventeen (17) additional total claims.

Claims 1-37 are all the claims presently pending in the application. The specification, drawings, and claims 1-4 are amended to more clearly define the invention and claims 7-37 are added. Claims 5 and 6 have been withdrawn from prosecution. Of the remaining claims, claims 1 and 16 are independent.

These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicants also note that, notwithstanding any claim amendments herein or later during prosecution, Applicants' intent is to encompass equivalents of all claim elements.

Claim 3 stands rejected under 35 U.S.C. § 112, first paragraph. Claims 1-3 stand rejected under 35 U.S.C. § 102(b) as being unpatentable over the Gall reference. Claims 1-2 and 4 stand rejected under 35 U.S.C. § 102(b) as being unpatentable over the Ostrovsky et al. reference. Claims 1-3 stand rejected under 35 U.S.C. § 102(b) as being unpatentable over the Laster reference. Claims 1-2 and 4 stand rejected under 35 U.S.C. § 102(b) as being unpatentable over the Ostrovsky et al. reference.

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

A first exemplary embodiment of the claimed invention, as defined by, for example, independent claim 1, is directed to a cross joint that includes a cross shaft member, rolling members and bearing cups. The cross shaft member includes four shafts each having a neck portion and a race portion, and shoulder portions between adjacent neck portions. The rolling members are adapted to rotate on the race portions and the bearing cups are fitted to the respective shafts via the rolling members. The race portions and the shoulder portions are subjected to roller burnishing for increasing a hardness of each surface of the race portions and the shoulder portions and for increasing a residual compressive stress immediately below each of the surfaces.

A second exemplary embodiment of the claimed invention, as defined by, for example, independent claim 16, is directed to a cross joint that includes a cross shaft, at least one roller on a race and a bearing cup. The cross shaft includes a plurality of shafts each having a neck and a race, and at least one roller burnished shoulder between two of the necks. The bearing cup is fitted to one of the plurality of shafts via the at least one roller.

Conventional cross joints have experienced fatigue breaking or bending fatigue at the shoulder area between the shaft neck areas because of the large bending stress experienced during operation.

In stark contrast to the conventional cross joints, the present invention provides a roller burnished shoulder between the necks of the shafts. In this manner, the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders can be increased and, therefore, the life of the cross joint is extended. (Page 15, lines 2-13).

II. THE 35 U.S.C. § 112, FIRST PARAGRAPH REJECTION

The Examiner alleges that claim 3 contains subject matter that was not described in the specification. In particular, Examiner Binda notes that Figure 3 indicates negative residual compressive stresses, while claim 3 and the specification recite positive residual compressive stresses. While Applicant submits that such would be clear to one of ordinary skill in the art to allow them to know the metes and bounds of the invention, taking the present Application as a whole, to speed prosecution Figure 3 has been amended in accordance with Examiner Binda's very helpful suggestions.

In view of the foregoing, the Examiner is respectfully requested to withdraw this rejection.

III. THE PRIOR ART REJECTIONS

A. The Gall reference rejection

Regarding the rejection of claims 1-3, the Examiner alleges that the Gall reference teaches the claimed invention. Applicants submits, however, that there are elements of the claimed invention which are neither taught nor suggested by the Gall reference.

The Gall reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing (claim 1); and 2) a roller burnished shoulder (claim 16). As explained above, this feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

The Gall reference discloses that a heat treatment is performed after roller burnishing and, thus, a hardness of each of the surfaces of the race portions and the shoulder portions and

the residual compressive stress immediately below these surfaces are not increased.

Indeed, the Gall reference actually teaches away from performing a heat treatment before roller burnishing because it would be difficult to form the grooves by plastic deformation.

In particular, the Gall reference discloses a cross joint which includes trunnions (shafts) which are grooved to provide alternately spaced lands 30 and grooves 32 for providing improved oil retention (page 2, lines 3-7). The Gall reference further discloses roll burnishing the shafts to create a projection 29 on either side of the groove 32 which slightly overlaps the bottom 27 of the groove (Fig. 5, page 2, lines 22-27). Therefore, the Gall reference only discloses roll burnishing the shafts and does not teach or suggest a roller burnished shoulder.

Therefore, the Gall reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection of claims 1-3.

B. The Ostrovsky et al. reference rejection

Regarding the rejection of claims 1-2 and 4, the Examiner alleges that the Ostrovsky et al. reference teaches the claimed invention. Applicants submit, however, that there are elements of the claimed invention which are neither taught nor suggested by the Ostrovsky et al. reference.

In particular, the Ostrovsky et al. reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing (claim 1); and 2) a roller burnished shoulder (claim 16). As explained above, this feature is

important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

Indeed, the Ostrovsky et al. reference does not mention anything at all that is even remotely related to roller burnishing, let alone roller burnishing a shoulder.

Further, the Ostrovsky et al. reference actually teaches away from roller burnishing the shoulder.

As is clearly explained by the specification of the present application, roller burnishing tends to increase the hardness of a material. Therefore the present invention increases the hardness of the shoulder area of the cross joint by roller burnishing the shoulder.

In stark contrast, the Ostrovsky et al. reference specifically explains that “the sections near the base of the cross arm must have a higher resistance to static and impact bending. Therefore, the hardness of these sections must be lower in order to reduce brittleness.” (Emphasis added, col. 1, lines 25-29; col. 2, lines 31-40).

In other words, the Ostrovsky et al. reference actually teaches away from roller burnishing the shoulder because roller burnishing increases the hardness of the shoulder and the Ostrovsky et al. reference specifically teaches that the shoulder hardness “must be lower.”

Therefore, the Ostrovsky et al. reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection of claims 1-2 and 4.

C. The Laster reference rejection

Regarding the rejection of claims 1-3, the Examiner alleges that the Laster reference

teaches the claimed invention. Applicants submit, however, that there are elements of the claimed invention which are neither taught nor suggested by the Laster reference.

In particular, the Laster reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing for increasing a hardness of each surface of the race portions and the shoulder portions and for increasing a residual compressive stress immediately below each of the surfaces (claim 1); and 2) a roller burnished shoulder (claim 16). As explained above, this feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

The Laster reference discloses an induction heating tool 58 that heats the surfaces of the races 55 and 56 (col. 2, lines 59-63). Therefore, for the same reason explained above with respect to the Gall reference, the Laster reference does not disclose increasing a hardness of each of the surfaces of the race portions and the shoulder portions and increasing the residual compressive stress immediately below these surfaces.

Rather, the Laster reference only discloses burnishing the "inner and outer races 55 and 56" of the cross joint (col. 2, lines 57-59 and col. 3, lines 30-31).

Indeed, the Laster reference does not mention doing anything at all to the shoulders, let alone roller burnishing the shoulders.

Therefore, the Laster reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection of claims 1-3.

IV. FORMAL MATTERS AND CONCLUSION

The Office Action objects to the specification and, where appropriate, this Amendment amends the Specification in accordance with Examiner Binda's very helpful suggestions.

However, the Office Action objects to the use of "SUJ2" and "S54C or S55C" because the Examiner is not familiar with these terms. Indeed, the Examiner alleges that these terms are "unknown."

Contrary to the Examiner's understanding, the terms "SUJ2," "S54C," and "S55C" are well known standards that are used to identify the chemical composition of steel. For example, SUJ2 steel is one of the most common types of bearing steel. Therefore, Applicants respectfully submit that these terms are well known to those of ordinary skill in the art and are not "unknown." Applicants respectfully request withdrawal of these objections.

The Office Action objects to the drawings. This Amendment encloses a replacement drawing sheet which corrects Figure 3 to remove the negative (-) symbols. Applicants respectfully request withdrawal of this objection.

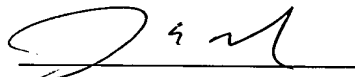
In view of the foregoing amendments and remarks, Applicants respectfully submit that claims 1-37, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 2/22/05


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AMENDMENTS TO THE DRAWINGS:

The attached sheet of drawings includes changes to Figure 3. This sheet, which includes Figure 3, replaces the original sheet including Figure 3. In Figure 3, the negative symbols (-) have been removed.

Attachment:

Replacement Sheet



FIG. 3

